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OFFICE OF ENFORCEMENT AND COMPLIANCE ASSURANCE

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PROCESS-BASED INVESTIGATION GUIDE

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GUIDE FOR CONDUCTING PROCESS-BASED INVESTIGATIONS

WHAT IS THE PURPOSE OF THIS DOCUMENT?

The purpose of this document is to:

- Introduce and define the concept of "process-based" investigations
- Discuss the usefulness of this "tool"
- Provide a "road map" to planning and conducting these types of investigations

This document focuses on the unique aspects of the “process-based” investigation and is meant to supplement, not replace, general investigation or media (law) specific protocol. The later guidance can be found in numerous existing documents such as the basic training manual entitled “Conducting Environmental Compliance Inspections” prepared by EPA Region 10 and the “RCRA Inspection Manual.” Therefore, in-depth discussion of issues, such as sample collection or documentation of findings, is not provided here.

Examples presented in the document, although primarily focusing on iron and steel making, are for illustration purposes only; the procedures discussed are applicable to all types of manufacturing facilities.

WHAT IS A “PROCESS-BASED” INVESTIGATION?

A "process-based" investigation is an investigation that initially focuses on, and is subsequently based on, a comprehensive understanding of the facility processes.[1] The process-based investigation includes tracking raw materials

[1] *"Processes," as used in this document, include all facility operations and activities, including industrial and manufacturing operations, raw materials, product, co-*

through the industrial operations, identifying by-product, co-product and products, identifying wastes generated, and determining how these wastes are ultimately managed.

Figure 1 shows a general summary of the elements to be addressed and evaluated in the early stages of a process-based investigation. This evaluation provides the basis for addressing primary investigation objectives, such as determining single or multimedia regulatory compliance status, identifying pollution prevention opportunities, or providing compliance assistance. Therefore, the purpose of a process-based investigation is not just to obtain an in-depth understanding of facility processes, but to use this knowledge to conduct more complete compliance monitoring, pollution prevention, compliance assistance, etc., investigations.

The purpose of a process-based investigation is to obtain an in-depth knowledge of facility operations and use this knowledge to make more informed investigation evaluations and determinations. Process-based investigations are appropriate for both single and multimedia regulatory compliance evaluations, as well as other environmental protection purposes.

For instance, if the overall investigation objective is to determine facility compliance with Resource Conservation and Recovery Act (RCRA) requirements (a single-media compliance evaluation), then facility processes will initially be

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product, byproduct generation and waste management practices, and maintenance activities. As used herein, an "investigation" comprises all activities from planning, through on-site facility visit, to information evaluation, and report preparation. The "investigation" includes an "inspection" which is the on-site facility visit.

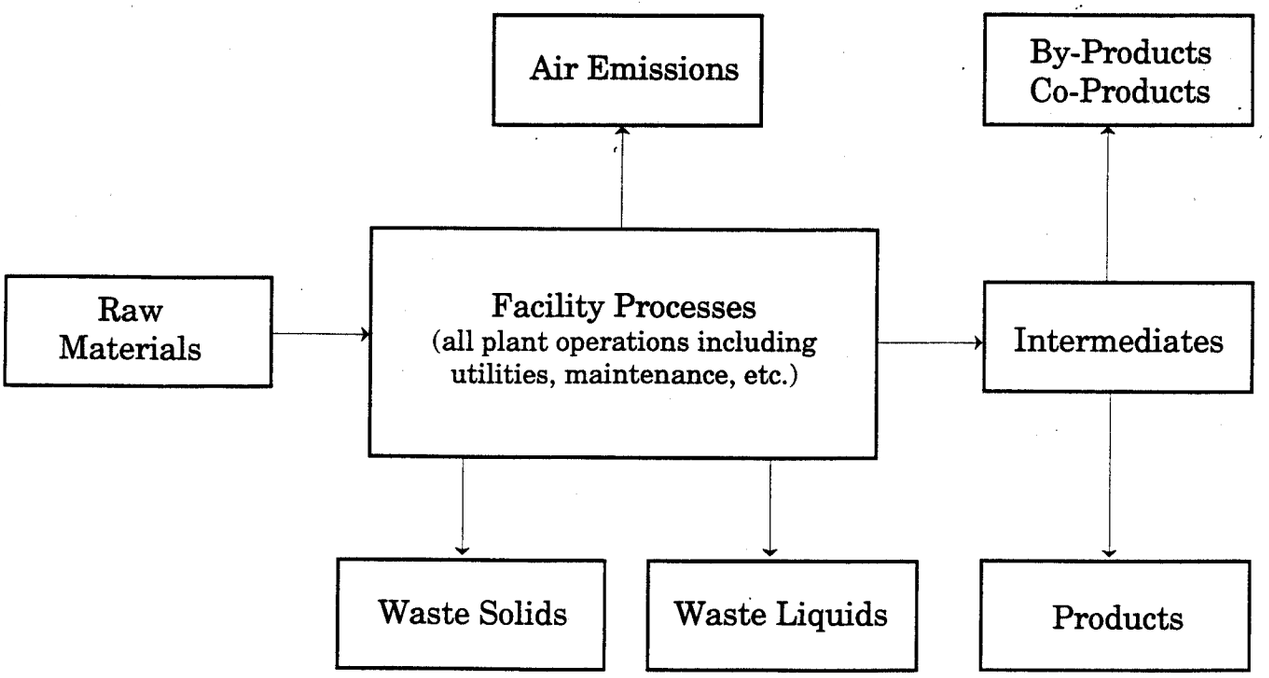


Figure 1
GENERAL GENERIC PROCESSED-BASED INVESTIGATION FOCUS AREAS

evaluated to identify all solid wastes and potential RCRA regulated hazardous wastes and activities. A determination will then be made to identify actual regulated wastes/activities. Finally, the compliance status of management of each regulated wastestream and/or activity is determined.

WHY CONDUCT A PROCESS-BASED INVESTIGATION?

Heightened interest in industry sectors, in-depth and/or multimedia compliance determinations, compliance assistance, pollution prevention, and holistic plant evaluations has increased substantially during the past several years. This interest has led to a necessary focus on waste producing operations at manufacturing facilities, and a concurrent need for process-based investigations.

Process-based investigations are, in many cases, the only method to:

- Determine the complete universe of regulated facility wastes/ activities
- Evaluate accuracy and completeness of facility self-reporting data/ permit application information
- Identify all actual or potential facility environmental impacts
- Obtain information important to permit development
- View the facility "holistically"
- Help ensure effective communication with facility personnel/ understanding of regulated wastes/activities
- Find pollution prevention and waste minimization opportunities
- Identify opportunities for supplemental environmental projects (SEPs)

Information obtained from process-based investigations can be used for subsequent compliance determinations, as well as for compliance assistance and pollution prevention endeavors. Such information has been used to help focus limited regulatory resources on enforcement actions that address the more egregious environmental problems, which might not have been apparent before the investigation.

WHAT TYPE OF FACILITIES ARE APPROPRIATE FOR THESE INVESTIGATIONS?

Process-based investigations can be conducted at, and may be appropriate for, any size facility. Although they are inherently "multimedia" in scope and are most effective when a complete facility evaluation is required, process-based investigations have also proved appropriate during single-media or limited scope activities. Although this guide is oriented toward evaluations at larger or more complex facilities, normally conducted by multi-person teams, the methods and principles can be readily applied to much smaller and simpler facilities that may be visited by small teams or a single technical expert. The decision to conduct a process-based investigation is based on numerous issues including objectives, expected outcomes, and resource availability.

WHAT TYPE OF EXPERTISE IS DESIRABLE FOR TECHNICAL EXPERTS CONDUCTING THESE INVESTIGATIONS?

As with other investigations, team make-up, including knowledge, skills, and abilities, should be generally in-line with facility size, complexity, and investigation objectives. Because an evaluation of industrial processes is required, one or more investigators should have some knowledge (either first hand or developed through background review, as discussed later) of the specific

processes of the facility and wastestream treatment methods and technologies. For multi-regulatory (multimedia) investigations, knowledge of multiple and cross-program compliance issues is necessary.

A minimal team for a large complex process-based multimedia compliance investigation would normally consist of inspectors familiar with the processes to be investigated with expertise in air, water, and hazardous waste programs. Ideally, the inspectors would be cross-trained in several other media programs (such as Safe Drinking Water Act, Toxic Substances Control Act, etc.). This level of experience may not be necessary at smaller, less complex facilities with narrower investigation objectives that could be evaluated by a single investigator with appropriate technical background.

WHAT ARE THE COMPONENTS OF PROCESS-BASED INVESTIGATIONS?

In general, a process-based investigation can be divided into the following three major activities.

1. Preparing for the investigation
2. Conducting the on-site inspection
3. Reporting investigation findings

The following guidance is organized by the above three activities. Illustrative examples and specific discussions of some concepts are provided in the appendices.

HOW TO PREPARE FOR A PROCESS-BASED INVESTIGATION

As with any investigation, planning is a critical step in efficient and effective execution of a process-based investigation. The various steps in proper investigation planning are somewhat dependent on specific aspects and requirements of each investigation. However, the following steps are virtually always required.

- Define investigation objective(s) (identify purpose, desired end-point, etc.) and scope (breadth and depth).
- Compile and evaluate facility background information (getting "up-to-speed" with facility processes, regulatory requirements, and special issues).
- Identify investigation "team" (choosing proper expertise mix or individual).
- Develop investigation plan/strategy (on-site activities, logistics, schedules).

Define Investigation Objectives/Scope

Probably the two most important "front end" tasks in preparing for the investigation are defining investigation objective(s), and identifying project scope because they are the basic building blocks for all subsequent activities. Once defined, these two components enable investigators to identify what is to be inspected, to what depth or level of detail, and for what purpose. This, in turn, will dictate what background information should be compiled and reviewed; the knowledge, skill, and experience mix needed in the investigation team; and help define investigation strategy and required resources.

While the overall focus of process-based investigations can vary from compliance monitoring to compliance assurance, one common objective is to obtain an understanding of facility processes to identify all regulated wastes/operations. This provides information to determine accuracy and completeness of facility self-reporting data.

Compiling/Evaluating Background Information

As with other investigations, the purpose of compiling and evaluating available background information is to become "smarter" about the facility and facility issues to ensure efficient use of on-site time and to help assure that important issues are not "missed" during the on-site inspection.

Because one of the initial activities in a process-based investigation is an evaluation of facility industrial operations and supporting activities in regards to wastes/byproducts/co-products generated and actual/potential environmental impacts, an understanding of facility operations is critical for a successful on-site inspection. Therefore, in addition to reviewing information related to the primary investigation objective(s), such as compliance monitoring, compliance assistance, etc., it is important to compile and review background information regarding facility operations.

To prepare for a process-based investigation, appropriate information should be compiled and reviewed.

While the scope of this document is not to provide a complete inventory of background information sources, the following have been found to be useful in developing knowledge of both generic and specific processes.

- Kirk-Othmer Encyclopedia of Chemical Technology. Wiley, 3rd ed., 1989; 4th ed. in publication process (basic process information/flow diagrams)

- U.S. EPA Effluent Guidelines Development Documents (process information for most industrial sectors focussing on wastewater generation)

- U.S. EPA RCRA hazardous waste listing documents

- Chemical Engineering Textbooks (basic process information)

- Sector experts, knowledgeable technical contacts, and co-workers

- U.S. EPA Sector Notebooks (overview of industry and operations)

- Trade journals

- Electronic process databases (e.g., Tomes by Micromedex, Hazardous Substances Data Bank)

- Dun & Bradstreet [facility Standard Industrial Classification (SIC) codes]

- Facility applications for air, wastewater discharge, and hazardous waste management permits (site-specific information on processes/ activities associated with the generation of the regulated waste)

- Information reported by the facility under the Emergency Planning and Community Right-to-Know Act (EPCRA)

- Reports of previous site inspections and discussions with the inspectors (site-specific information on site operations and past problems)

- Computerized databases maintained by EPA and state media programs

- Occupational Safety and Health Administration (OSHA) inspector reports (site processes and problem areas)

- Formal Information Request [if inspection is to be announced, submitting an information request under the various EPA/state

authorities will provide site-specific process information (Appendix A is an example of an information request letter requesting process-based information.)]

Information obtained from the above sources should be viewed as a starting point, not a comprehensive accounting of all facility processes and identification of regulated wastestreams. Much of this information is "generic" and may be obsolete or of minimal use because of company regulatory interpretations, incomplete wastestream listings, and changing facility processes.

The extent and effort dedicated to gathering and evaluating background information is a function of investigation objectives, level of available resources and facility complexity.

At a minimum, the investigator should be well prepared and have a basic understanding of industrial operations/supporting activities and wastes generated and can comfortably discuss associated issues with facility personnel. For more complex facilities, it is often useful to develop a “conceptual model” of the facility operations/activities and wastes generated (Appendix B provides further information for building such a model).

At larger facilities, contractor operations may be integrated into plant processes so that the contractors are actually the wastestream generator. Also, some contractors treat or manage the solid/liquid wastestreams. Whether they are the wastestream generator or manager, they may have reported their activities to the regulatory agencies separate from the “host” facility. This should be explored as part of the background information review. To do this, a list of major facility contractors and their operations/functions should be obtained, if possible, during background information gathering.

Comparison of background information from the target facility to other, similar type facilities often yields useful information. For example, TRIS emissions data can be compared by obtaining database retrievals for facilities with the same standard industrial classification (SIC) code(s). Gross differences between facility reports can provide clues to process differences and identify areas for further inquiry. Also, significant year to year differences and/or increases/decreases in chemicals listed for the target facility could indicate process or other changes that should be investigated (Appendix C is an example of TRIS comparisons between several similar industrial facilities).

Additionally, information "gaps" should be identified so that the required information is obtained during the on-site portion of the investigation.

In summary, the goal of the background information review is for the investigator(s) to obtain knowledge of site processes, wastestreams generated, and waste management operations based on generic and site-specific information. This enables a preliminary understanding of plant processes, which must be verified and revised while on-site. Regulations applicable to site activities, regulated wastestreams, and significant contractor operations, as well as information "gaps" are identified. Obviously, the size and complexity of the facility and the investigation objectives will dictate the level of detail required during the background review.

Team Formation/Interaction

As with all investigations, selection of the proper individual or team of individuals is critical. The expertise should be consistent with investigation objectives, level of available resources, and facility complexity. If a team is to be used, communication between members is of critical importance. A team or

project leader to coordinate team activities should be identified. The team leader must encourage communications so that background information and knowledge are freely shared throughout the investigation. This communication of observations and cross-media impacts becomes the real strength of the team and enables the comprehensive view of the facility, especially when all team members cannot observe all operations.

Develop Investigation Plan/Strategy

An important facet to any investigation is developing the site-specific plan. The purpose of the investigation plan is to identify investigation objectives, activities, assignments, and time lines, help ensure that all team members are aware of these issues, and that required information is obtained during the investigation in an efficient and effective manner. To formulate an effective plan, some knowledge of general facility operations, waste management procedures, applicable regulations and available resources is critical (and should be obtained during the background review). The scope (breadth and depth) of the plan may be fairly simple or complex, and will vary as a function of the investigation objectives and size and complexity of the target facility. Most plans will include:

- General facility background, including known processes and regulatory issues
- Investigation objectives
- Inspection activities
- Tentative schedule for investigation activities
- Safety plan

For complex facilities, the investigation plan can also include prioritizing the manufacturing operations and waste management activities to be evaluated. A useful strategy used for evaluating facility operations is to follow material flows through the plant. Material flows should be followed, to the extent possible, beginning with raw material receiving and storage facilities; then to manufacturing areas, utilities and maintenance areas, product storage facilities; and finally, to waste management units. The strategy should be somewhat flexible so that "mid-course corrections" can be made. Appendix D provides a brief discussion of an inspection strategy used at a complex iron and steel facility.

Depending on investigation objectives and focus, there may be a need for sample collection. Samples might be needed for determining if a particular wastestream is a characteristic hazardous waste, or verifying that a company has adequately characterized a wastewater discharge. In any case, evaluation of the need and purpose for sampling should be thoroughly evaluated to ensure that proper samples are taken. Additionally, if sample collection is anticipated or is a possibility, appropriate planning and documentation (such as preparation of a Quality Assurance Plan) must be completed before going into the field.

A determination must be made whether to announce the inspection to the facility or conduct an unannounced visit. This determination will depend on various factors including inspection objectives, strategies, and policy and should be made during the planning process.

An "announced" inspection, while providing an opportunity for the facility to make changes to realign themselves with regulatory requirements, helps ensure the presence of knowledgeable personnel necessary to describe facility processes and allows the facility time to

compile useful documents. However, both announced and unannounced process-based inspections have successfully been conducted.

If the inspection is to be announced, the investigators should take the opportunity to obtain as much facility specific information as possible during announcement communications. Company officials should identify major operations and their relationship to each other regarding material flows. If time permits, a written request for process and contractor information can be prepared and responded to by the company [Appendix A]. If this information is not requested in advance, it should be requested during the on-site inspection.

An aspect of investigation planning that should not be overlooked is the time/resources necessary to conduct a process-based evaluation. In general, more time and expertise is required to conduct a process-based investigation as compared to a typical "regulatory-based" investigation (where a complete understanding of the facility processes is not usually obtained because the initial focus is to evaluate the regulated units/activities based on facility self-reporting). The additional time required could be as little as a couple of hours to several days depending on the inspection scope and facility complexity as identified during project planning. Resource limitations should be identified during investigation planning so that realistic objectives can be met and alternatives (such as a prioritizing processes to evaluate) can be developed.

HOW TO CONDUCT THE ON-SITE INSPECTION

The on-site portion of the process-based inspection, like most other inspections, can be separated for purposes of discussion into various activities [Figure 2], including:

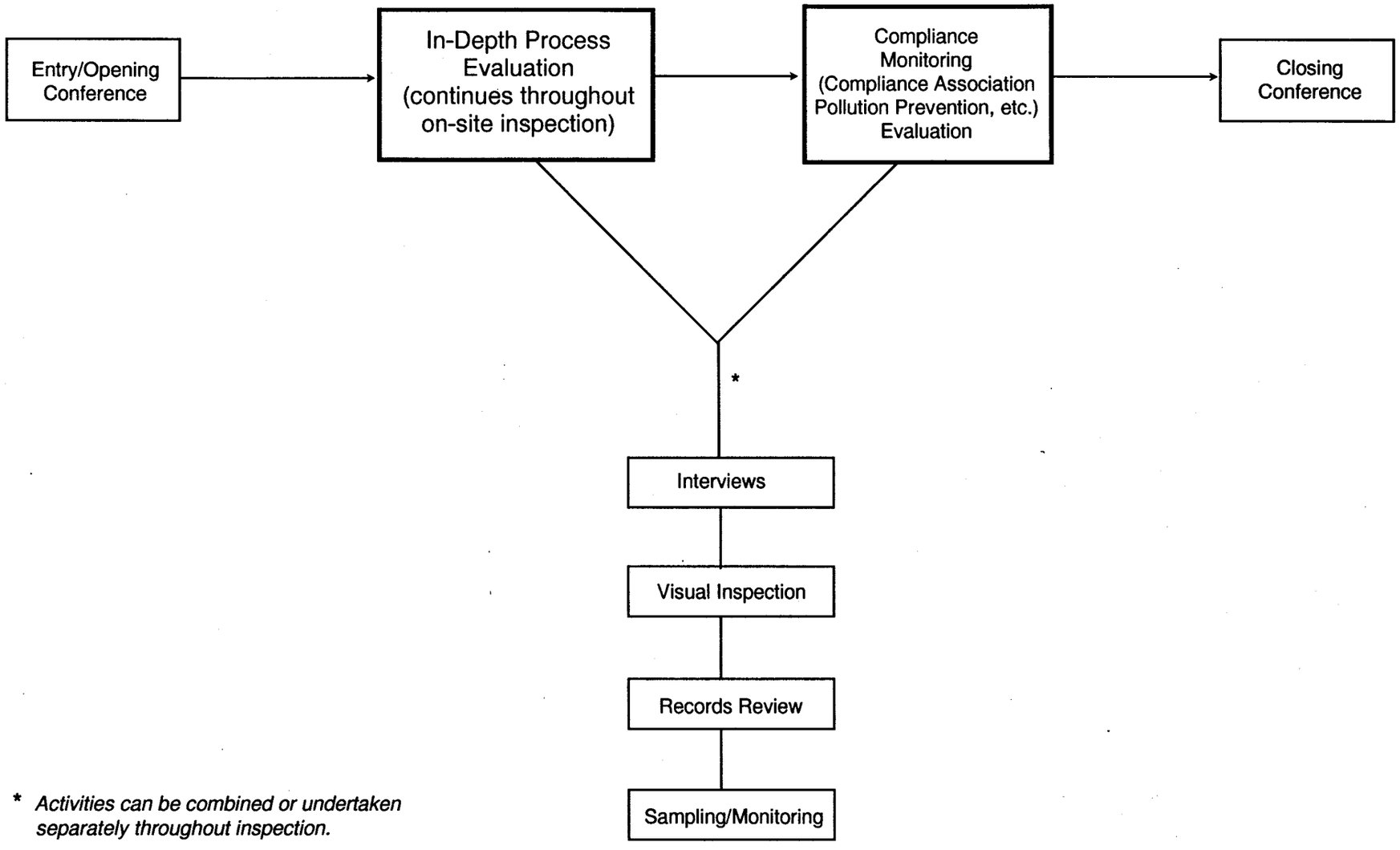


Figure 2
PROCESS-BASED ON-SITE INSPECTION ACTIVITIES

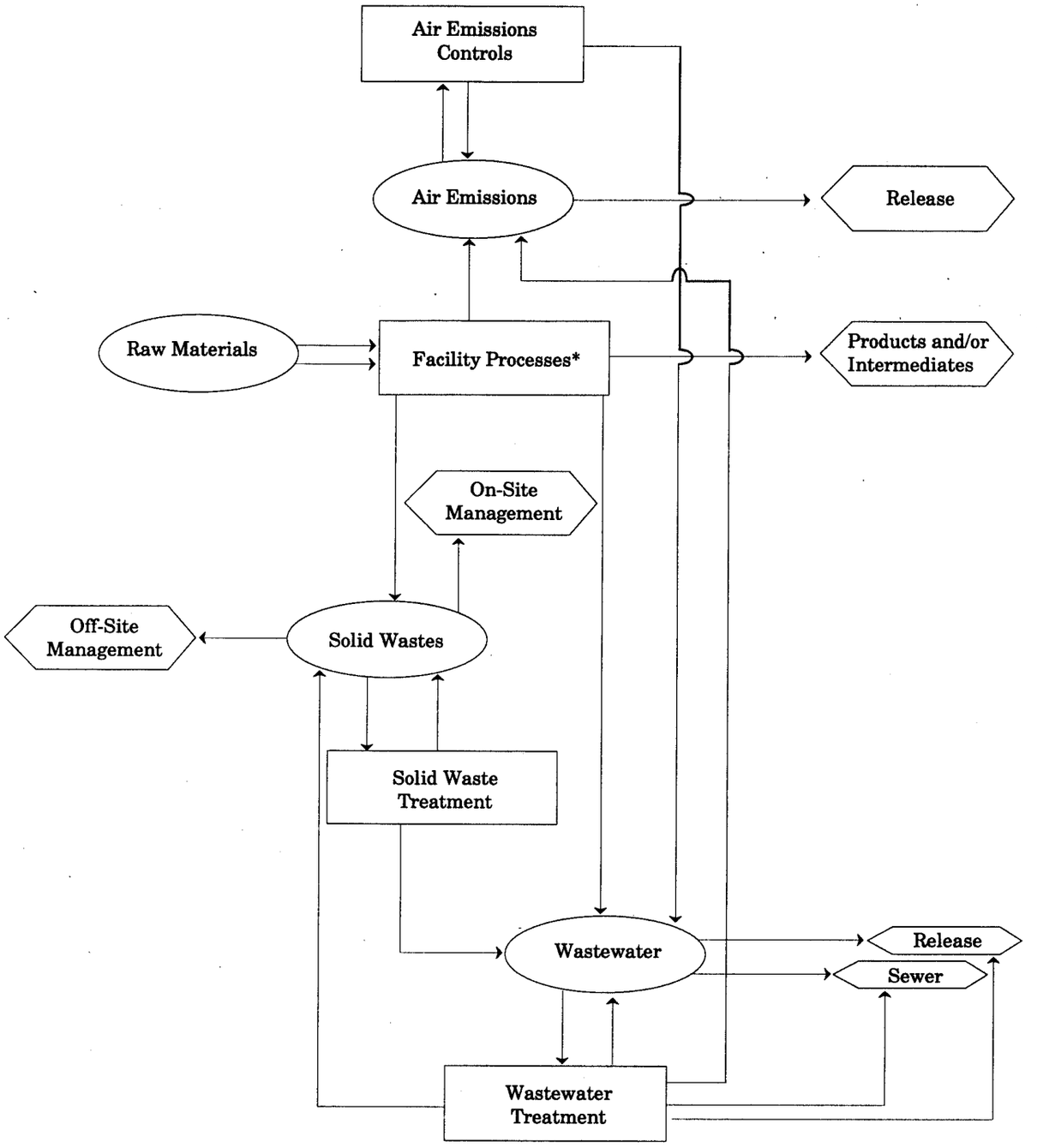
- Entry/Opening conference
- Evaluation of facility operations and activities (processes)
- Document/records review
- Interviews with facility personnel
- Visual observations of selected areas
- Sampling/monitoring
- Closing conference

While these activities are discussed separately, the primary purpose of most of these activities is to obtain information. The individual activities (except for the opening and closing conferences) are "intermingled" throughout the on-site inspection. Information obtained from each activity is used to "check and balance" information obtained from the other sources in order to get the most complete and accurate "picture" of facility processes.

Unlike most other inspections, the initial focus, and a continuing activity throughout the process-based inspection, is obtaining a relatively comprehensive understanding of facility manufacturing operations/facility activities and how they relate to regulated wastes/activities and/or environmental issues (although many inspections rely on at least a general understanding of facility activities, the process-based inspection requires an in-depth evaluation of waste generating operations/regulated activities). Figure 3 shows areas of focus for the process-based inspection. The investigator/ investigation team then uses this knowledge as a basis to carry out the major objective of the investigation (compliance monitoring, compliance assistance, pollution prevention, etc.).

The following discusses the above identified activities, <u>as they relate specifically to gaining an in-depth understanding of facility processes</u>.

Figure 3



* *Includes all facility operations, including maintenance, laboratories and utilities*

Figure 3
COMPREHENSIVE GENERIC PROCESSED-BASED INVESTIGATION FOCUS AREAS

Entry/Opening Conference

During the opening conference, the company should provide an overview of plant organization and processes. This information is used to identify (and verify) major facility processes and can aid in scheduling subsequent interviews and specific process inspections. For example, if Operation A and Operation B are in different major organizational units (i.e., Divisions), it is unlikely that interviews addressing them would be conducted concurrently.

Company safety procedures should also be discussed during the opening conference.

> **Safety is an issue of increased concern during process-based inspections because potentially dangerous manufacturing areas, not normally visited, may be thoroughly examined.**

Company officials should be asked about special safety equipment or training that may be required to enter specific plant areas. Investigators should follow company safety procedures, as a minimum, and be alert for and comply with, all warning signs. Experience has shown that not all plant personnel have equal respect for safety procedures - safety must be the responsibility of the investigator while on-site.

Other items that should be discussed during the opening conference are similar to other type inspections, such as use of vehicles on-site, meeting times, photograph policies, confidentiality, etc. Additionally, it is also useful at this time to have the facility provide a conference room the team can use to review documents, discuss issues, make phone calls, etc.

Evaluation of Facility Operations

Evaluation of facility processes is usually accomplished in three steps.

1. Brief initial plant orientation tour

2. In-depth discussion of specific plant processes with facility engineers (or other knowledgeable personnel) using flow diagrams/blueprints

3. "Fine tuning" of facility knowledge throughout the remaining part of the inspection through document review, visual observation, further discussions with facility personnel and inspection team interaction (obviously, on relatively simple facilities these steps can be combined)

Process-based inspections may involve discussing, reviewing, and possibly receiving confidential business information. Investigators need to be sensitive to legitimate company concerns and ensure that such information is protected in compliance with federal regulations (40 CFR Part 2).

The general orientation plant tour (the "windshield tour") should be provided for the investigation team as a group. Once the investigator/ investigation team has a general overview of facility operations, more detailed discussions regarding processes take place. These may be conducted as a complete team, or in smaller groups, depending on personnel, objectives, and available resources.

The inspection team should ensure that knowledgeable personnel are being interviewed about plant processes. These usually are the facility operations managers and operators, but can include environmental staff. Unless there is some overriding reason not to, a schedule of process staff

interviews and operation inspections should be set up early in the inspection, so that the company can plan ahead and minimize the disruption to plant operations.

The process evaluation normally begins with interviews of operation and activity managers, engineers, and operators. Later, the information obtained is verified by records review and visual inspection. The initial process interviews are best done in a quiet office or conference room, not in the noisy process area. Block process flow and/or piping and instrumentation diagrams (P&ID) are reviewed starting with raw material received, processing, by-product, product, and waste generation, step-by-step, to confirm all information and ensure that no products, byproducts, residues, or wastestreams have been omitted or misidentified. The generic/specific process information compiled during investigation background information compilation/evaluation should be used during interviews and plant tours to ensure all facets of the process and resulting wastestreams are discussed.

Beware of industry-specific "terms of art," as they can be very misleading. A "chilled brine" at one facility was actually methylene chloride, which had leaked and contaminated the underlying groundwater. The investigator must be willing to ask for clarification where "terms of art" are suspected.

Some often overlooked issues/processes and activities include:

- Recyclable material streams (the company may not consider them to be wastes as they are not "disposed of")
- Facility "support activities" such as maintenance, research facilities, and laboratories may not be considered by the facility as

"processes," but usually generate/manage regulated wastes and should be included as part of facility operations evaluations.

- Chemical storage areas/mixing rooms that often contain documents regarding types of substances/raw materials used on-site [material safety data sheets (MSDS), material labels, etc.]

- Facility "utilities" such as boilers, power and water treatment systems sometimes generate regulated wastes.

- Contractor activities, such as construction/demolition, maintenance, and unit process operations can result in environmental/noncompliance problems.

Process interviews can be time consuming, but need to be of adequate detail and thorough enough so that major or environmentally significant wastestreams are identified within the objectives and scope of the investigation. If the process is understood, wastestreams identified, and waste management practices discussed, it is probably time to proceed to other areas of inquiry.

The condition and age of plant sewers are of environmental interest, especially at older plants. Leaking sewers can be contaminating the underlying groundwater and may constitute illegal waste disposal. Wastestreams discharged to nonmunicipal sewer systems may be subject to RCRA hazardous waste and land disposal restriction determinations. Consequently, questions about sewered wastes, sewer inspection and repair programs, and inspection/repair records should be asked.

Document Review

Document review is commonly used to supplement process knowledge obtained during the in-depth process interviews, determine waste management practices/facility compliance status, and identify compliance assistance and

pollution/waste minimization opportunities. Review of documents can also be used to verify previously provided information of facility operations (such as information obtained during visual observation and interviews of plant personnel) and identify actual or potential environmental problems. Document review is normally conducted throughout the process-based on-site inspection.

While state and federal regulations require facilities to maintain and have available many documents (shipping manifests, inspection records, etc.) that are useful in identifying environmental management operations and activities, the following documents have also been found to be useful in evaluating facility processes.

- Facility map(s) showing buildings and waste management areas/ operations
- Plant personnel organization chart
- Piping and Instrumentation Diagrams (P&IDs) [Appendix E]
- Facility water/wastewater balance information [Appendix F]
- Plant sewer map(s) showing all building collection systems, laterals and sewer mains, heat/material balance sheet(s) for the process(es)
- Operation Manual for specific manufacturing or waste management
- OSHA Process Safety Management Manual for Highly Hazardous Chemicals (required by 29 CFR 1910.119)
- List of emission points or wastestreams that have: (a) required, or (b) voluntary monitoring (includes air, sewers, land, surface water)
- List of imported or exported feedstock, recyclables, and waste materials

- Excess air emissions reports
- Spill logs

The information may be available in both paper copy and electronic format. If available, electronic format may facilitate analysis and expedite investigation report preparation. Information obtained during document review should be compared with that reported by the facility and obtained from other on-site activities to determine compliance and ensure an accurate picture of the issues.

An important element of document review is to understand internally-generated documents, how and when they are completed, the source of the information contained, and how they relate to other documents. Information from these documents are often critical in understanding facility operations and waste generation, tracking and management activities.

Interviews/Visual Inspection

Verifying process information generally involves inspecting and further discussing facility operations and waste management areas to ensure nothing has been overlooked during the interviews or omitted from the flow diagrams. This part of the inspection relies most heavily on investigator experience and, at large or complex facilities, is better done by a team of at least two.

One strategy used to verify process information at complex facilities requires two investigators working together: one tracks the facility processes on flow and/or P&ID diagrams, while the other tracks process and equipment (e.g., tanks, reactors, waste management units,

etc.) locations on a plant site map. Both investigators should ask questions; however, the one tracking facility processes normally takes the lead.

When appropriate (often while in process areas), the investigators should ask operators about types and frequency of upsets, and how materials are managed during upsets. As a courtesy and for safety reasons, the company "guide" should be consulted before approaching an operator for questioning. While in the operation area, look at each major unit or a “typical” major unit shown on process flow diagrams, and identify wastestream points of generation and management procedures, including the location of all pits, sumps, vents, and stacks.

Team members need to be constantly alert for operations, materials, tanks, and waste management activities not previously identified or discussed. These could also include anything unusual: unmarked or unexplained drums, visible emissions, odors, material piles, tanks, piping, open pipes near drainages, ventilation, or structures because they may reveal operations or waste handling activities not previously discussed. If discovered, the function and purpose should be determined. The investigator should never assume that there is a “good” and “regulatory compliant” explanation for an unusual item or activity.

At one facility, a question about a specially ventilated sump cover revealed the facility's concern about phosgene gas generation as a process byproduct, although phosgene gas had not been identified as a waste/byproduct during previous discussions.

All waste treatment systems associated with manufacturing wastes should be inspected. Treatment system operators should be asked about upsets,

influent and upstream monitoring, alarm locations and types, and problem or upset notification by production staff. (The degree to which there is effective communication can suggest the likelihood of treatment system upsets.) Treatment system bypassing capabilities should be discussed with the operator, as well as frequency of use. All treatment units and the flow options for each need to be identified.

Sampling/Monitoring

As with other inspections, sampling or on-site monitoring can be useful in gathering information about facility operations, including waste management activities. Issues associated with sampling/monitoring, including identifying clear objectives and Quality Assurance/Quality Control needs, do not differ significantly from other types of inspections.

Closing Conference

The closing conference for process-based inspections does not normally differ from that conducted during other types of inspections. However, if a closing conference is conducted, the facility must be informed that information provided is only preliminary and subject to change as a result of more thorough evaluation.

HOW TO REPORT PROCESS-BASED INVESTIGATION RESULTS

Reporting results of a process-based investigation generally follow the same basic rules for reporting of "regulatory-based" investigation results. No single reporting format will satisfy the needs of all agencies conducting various types of process-based investigations (compliance monitoring/compliance

assistance, etc.). However, the following two points are emphasized to avoid report problems.

1. As with all investigation reports, the principles of clear presentation apply. This is especially important because process descriptions can be very complex, and the information may not be "usable" if the presentation is not "reader friendly."

   The process presentation should start at the beginning of the process (usually receipt/handling of raw materials) and work systematically toward the end (product). Figures/flow diagrams are extremely helpful and can eliminate (or supplement) the need for complicated narrative and should be included wherever possible. Because the objective of including a process description in the report is to provide a clear foundation for identifying/discussing facility problems/issues, the description should be of sufficient detail to enable the reader to understand facility operations associated with the identified issues/problems.

   The narrative should identify all significant wastestreams, their point of generation, and disposition, especially those wastestreams that are associated with follow-up issues (noncompliance, pollution prevention, compliance assistance, etc.). A summary table of wastestreams can be very useful to readers [Table 1].

2. Confidential business information should be avoided in reports, if at all possible, because of the resulting restrictions on subsequent use and distribution. A separate "confidential" report, containing the process information claimed confidential may be appropriate

and would allow the nonconfidential information (usually the bulk of the findings) to be used without constraint.

Table 1
EXAMPLE TABLE OF MAJOR WASTE STREAMS/SOURCES

Process Area	Solid Waste	Air Sources	Wastewater Source/Stream
Coke Plant	Tar decanter sludge Tar storage tank residues Breeze from wharf Drip leg condensate Muck oil Filters from fertilizer production	Coke oven gas Pushing emissions Lid and door emissions Quenching Combustion stacks Fugitive emissions	Quench water Ammonia still discharge Scrubber water Wharf water Non-contact cooling water Light oil recovery discharge Sanitary sewage
Blast Furnace	Clarifier sludge Drip leg condendate Flue dust Vacuum filter cake Slag	Stoves Boilerhouse Blast furnace tapping emissions Flare emissions Scrubber Lime silo Fugitive emissions	Cooling water Furnace seals Blast furnace recycle system Non-contact cooling water Boiler seals Zeolite regeneration Sanitary sewage
Steel Making	Slag Kish (skim) Acid plant clarifier sludge Sand filter sludge Scale Cold mill coolant Waste pickling acid Scarfing flash Grinder swarf Settling basin mud ESP dust Waste oil Baghouse dust from flux floor Debris from mold cleaning Roll grinder fines	BOF Soaking pits Pickling lines Hot metal transfer station Desulfurization station Flare emissions Ladle transfer Electrostatic precipitator Teeming Fugitive emissions	Cooling water: BOF, hot strip mill, primary rolling mill Descale water: hot strip mill, primary rolling mill Non-contact cooling water Zeolite regeneration Boiler blowdown Pickling rinsewater Pickling fume scrubber blowdown Sanitary sewage

APPENDICES

APPENDIX A

EXAMPLE PROCESS INFORMATION REQUEST

EXAMPLE PROCESS INFORMATION REQUEST

The information outlined in this request* is to assist us in understanding your company's operations, identifying processes for inspection, and reducing the time spent with process personnel. Information is requested for:

1. Coking
2. Sintering
3. Blast Furnaces
4. Basic Oxygen Furnace Shop
5. Hot Strip Mill
6. Cold Rolling Mills
7. Galvanizing Mills
8. Central Wastewater Treatment Plant (include any upstream treatment units)
9. Plant Maintenance Operations (include garages and machine shops)
10. Laboratories (research and development, process control and/or environmental monitoring)

Specific information needs for these processes are identified below. The information should be provided by _____.

1. Identify the building(s) in which processes or process groups are located.

2. Provide a schematic for each process or process group (see attached example). The schematic should, as a minimum, identify: (1) what is being produced as products and byproducts, (2) process steps and start-up date (month and year) for the current process or process group.

3. On the schematic, identify each wastestream leaving the process and its disposition (e.g., recovery, storage, discharge to sewers, discharge to air, collection for off-site treatment/disposal, collection for on-site treatment/disposal, etc.). Provide the state-assigned

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* *Request may be formal (e.g., RCRA, 3007 letter) or informal (e.g., provided to company contact by lead inspector).*

emission point source identification number for controlled air discharges (i.e., having air pollution control devices) and indicate the respective NPDES outfall for wastewater streams.

4. For each process indicate the presence of, as appropriate, side sumps, pump stations, scale pits, and any hazardous waste accumulation areas (55-gallons or more).

5. If a hazardous waste determination was made for a wastestream or group of wastestreams identified on the schematic, please provide results of that determination.

Contractor Operations

1. For the following contractors having operations at your plant, please provide complete company names; mailing addresses; principal contacts; and their telephone numbers, RCRA I.D. numbers, if applicable; and briefly describe the services rendered.

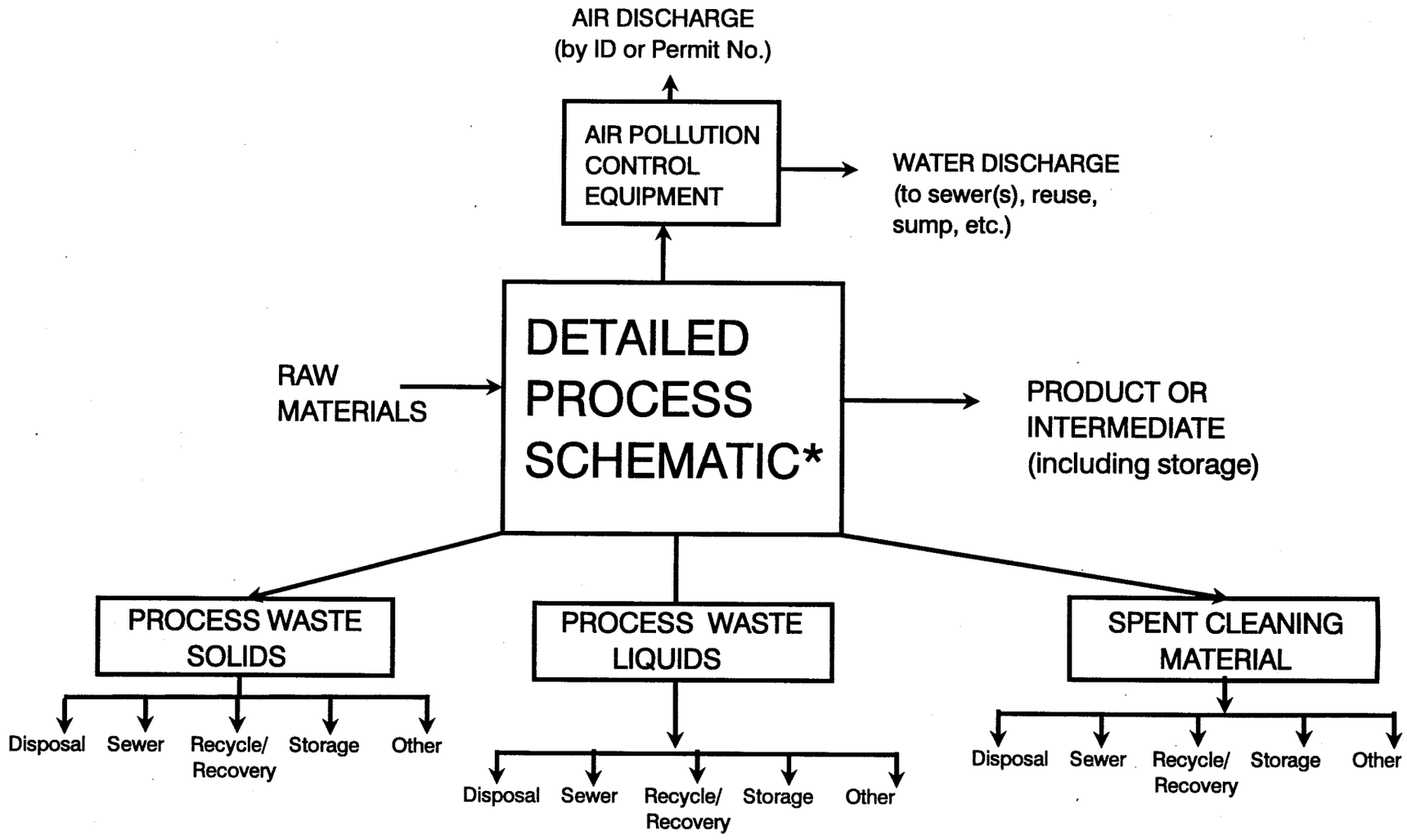
   a. Contractor 1
   b. Contractor 2
   c. Contractor 3
   d. Contractor 4
   e. Contractor 5
   f. Contractor 6
   g. Contractor 7

2. For the above listed contractors having operations at the your plant, please provide the information indicated above, as appropriate, in items 1 through 5, plus 6, as follows.

3. For each contractor, list any raw materials (feedstock) brought on-site from off-site sources. If this raw material is also derived from your plant, please indicate the approximate percentage derived from on-site and off-site sources.

4. Please identify any other contractor who has on-site operations involved in the processing; recovery; or reprocessing of raw materials (feedstock), byproducts, intermediates, recyclable materials, or wastes. For each contractor identified, please provide the information indicated in item 1 above.

EXAMPLE PROCESS SCHEMATIC



* The process schematic should be detailed and may require may boxes to adequately depict. Material quantities and process units need to be identified.

APPENDIX B

DEVELOPING A DETAILED FACILITY PROCESS MODEL DURING PLANNING

Appendix B
DEVELOPING A DETAILED FACILITY PROCESS MODEL DURING PLANNING

Preparation, as discussed here, focuses on identifying likely and/or known operations, wastestreams, and applicable regulations. A conceptual model of plant manufacturing operations, developed by investigation team members, is often helpful in assimilating and displaying background information on the facility. The model is typically based on both generic and site-specific information; the level of detail is dependent on project scope and objectives, information availability, member experience, and available time. A useful model form is a process block flow diagram(s) to which information can be added as it is obtained [Figures 1 and 2]. Process notes and questions are often developed to supplement the diagram(s). The flow diagrams can be generated using computer-based drawing programs, which are available to Agency personnel through the local area networks.

If generic and site-specific information are used to develop the model, judgement must be exercised in use of the composite information. At best, the model developed during background information review only indicates what conditions might be found at the inspected facility. The model should not be assumed to portray actual site conditions, but should be considered continually in draft form and updated whenever more accurate information is available, such as during the on-site inspection.

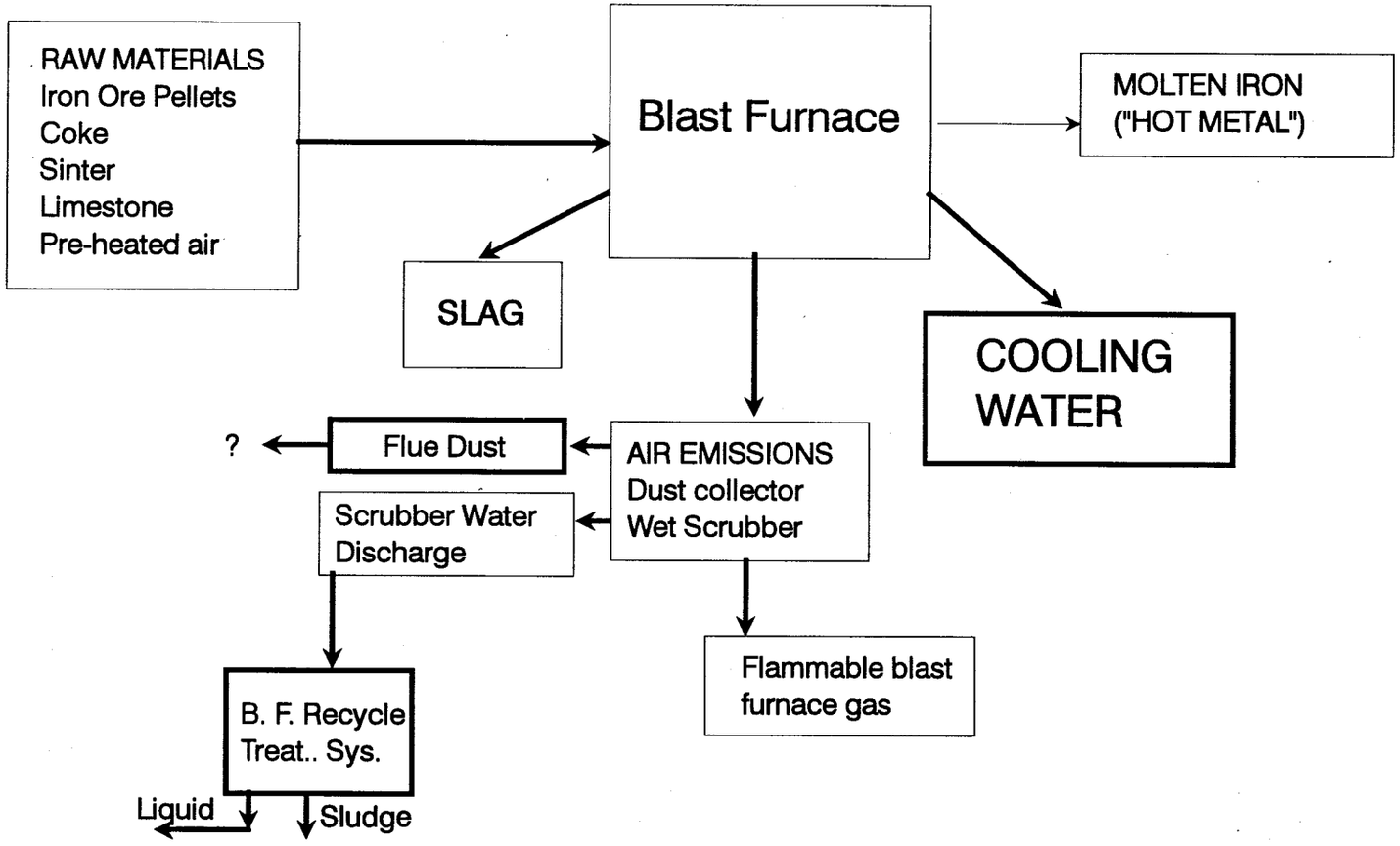
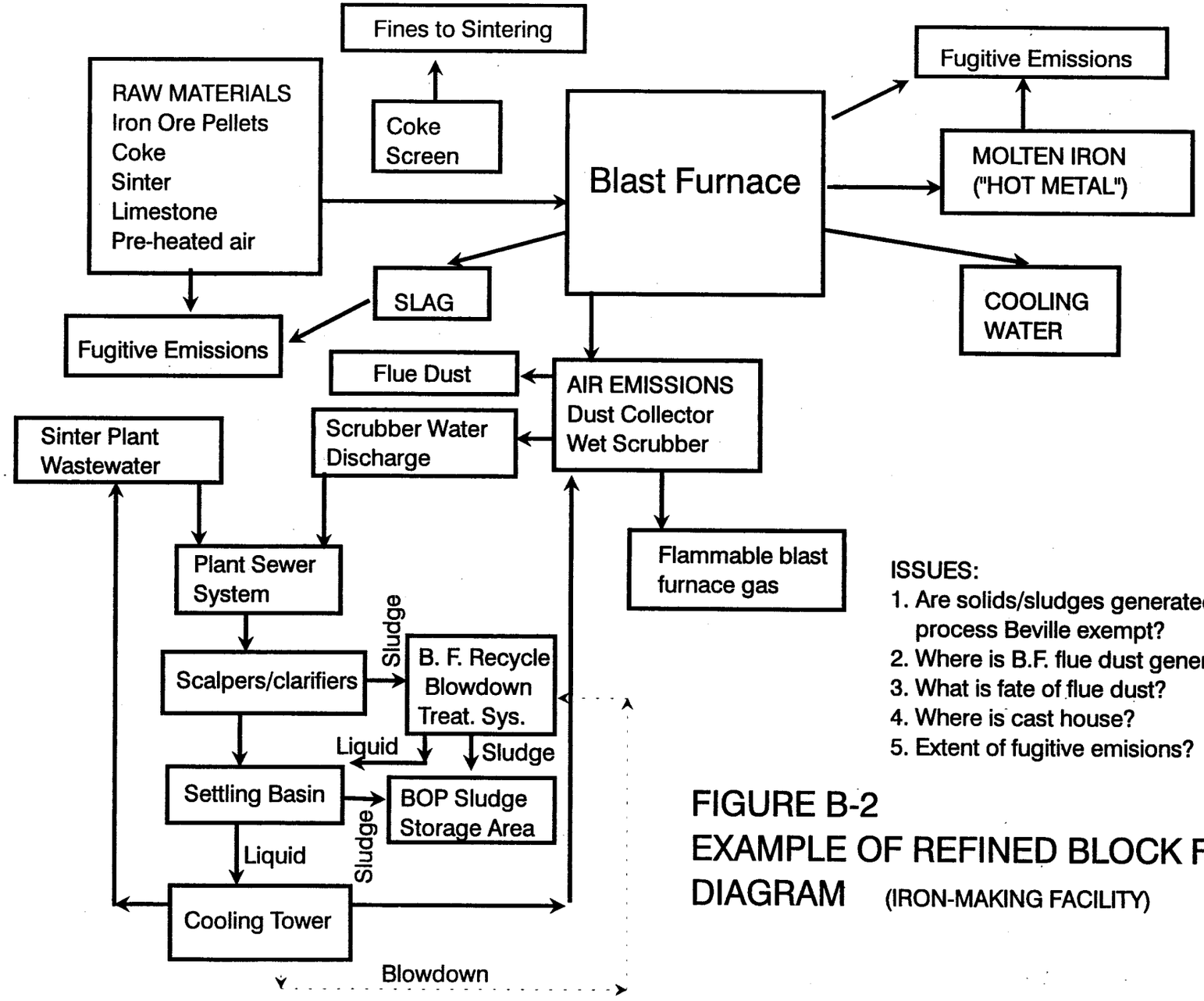


FIGURE B-1
EXAMPLE OF INITIAL BLOCK FLOW DIAGRAM

(IRON-MAKING FACILITY)



ISSUES:

1. Are solids/sludges generated from this process Beville exempt?
2. Where is B.F. flue dust generated?
3. What is fate of flue dust?
4. Where is cast house?
5. Extent of fugitive emisions?

FIGURE B-2
EXAMPLE OF REFINED BLOCK FLOW DIAGRAM (IRON-MAKING FACILITY)

APPENDIX C

EXAMPLE TRIS COMPARISONS BETWEEN SIMILAR FACILITIES

EPCRA
EXAMPLE COMPARISON OF PETROLEUM REFINERY FORM R SUBMITTALS
(Reporting Year Data - 1992)

Chemical	Refinery A	Refinery B	Refinery C	Refinery D	Refinery E
Refinery Size (bbls/day)	400,000	300,000	265,000	130,000	250,000
Ammonia					
Fugitive air		420	2,200	170	3,700
Stack air		900	19,000	550,000	170,000
Water		230,000	13,000		65,400
Land					0
Off-site			79		0
POTW				250	
Ammonia Nitrate					
Fugitive air			66		
Benzene					
Fugitive air	24,000	71,000	21,000	4,500	270,000
Stack air	4,200	112,000	1,500	6,200	18,000
Water		68			
Land	93				0
Off-site		1	732	210	5,648
POTW				10,000	
1,3 - Butadiene					
Fugitive air	900	390	160	15	230
Stack air				16	
N-butyl Alcohol					
Fugitive air				5	
Carbon Tetrachloride					
Fugitive air		930			
Carbonyl Sulfide					
Stack air		51,000			
Chlorine					
Fugitive air		11			0
Stack air					1,100
Chromium Compounds					
Fugitive air		500			10,000
Stack air	92			1	
Water	570	1,200			2,330
Land	610	4,300			0
Off-site	1,929	4,528		175	31,030
POTW				75	
Cobalt					
Off-site				8,100	14,840

Copper Compounds					
Fugitive air		250		22	
Stack air			15	180	
Water		490	62		
Off-site		170,000	6,679		
POTW				2,400	
Cresol					
Fugitive air					1,100
Stack air					51
Land					0
Cumene					
Fugitive air		34,000	110		6,600
Stack air		1,700			1,200
Water		68			0
Off-site					2,130
Cyclohexane					
Fugitive air	15,000	18,000	16,000	4	51,000
Stack air	780	110,000	2,000	660	1,100
Water		68			
Land	97				0
Off-site			534		651
POTW				250	
Dichlorodifluoro-methane (CFC-12)					
Fugitive air		168,000	45,000		
1,2-Dichloro ethane					
Fugitive air			77		
Stack air			2		
Off-site			79		
Diethanolamine					
Water					0
Off-site			4,600	99	0
Ethylbenzene					
Fugitive air	20,000	60,000	6,900	11	74,000
Stack air	2,800	3,700	330	210	9,000
Water		68			1
Land	330				0
Off-site		1	4,170	2,314	13,034
POTW				2,500	
Ethylene					
Fugitive air	23,000	480	8,400	490	25,000
Stack air				1,500	1,400
Ethylene Glycol					
Stack air		1,500			
Water		36,000			
Formaldehyde					
Fugitive air		1,500			
Stack air		250			
Water		200			
Off-site		170			
Glycol Ethers					
Fugitive air				18,000	

Note - This is not a complete table for refineries

APPENDIX D

EXAMPLE INSPECTION STRATEGY

Appendix D

EXAMPLE INSPECTION STRATEGY

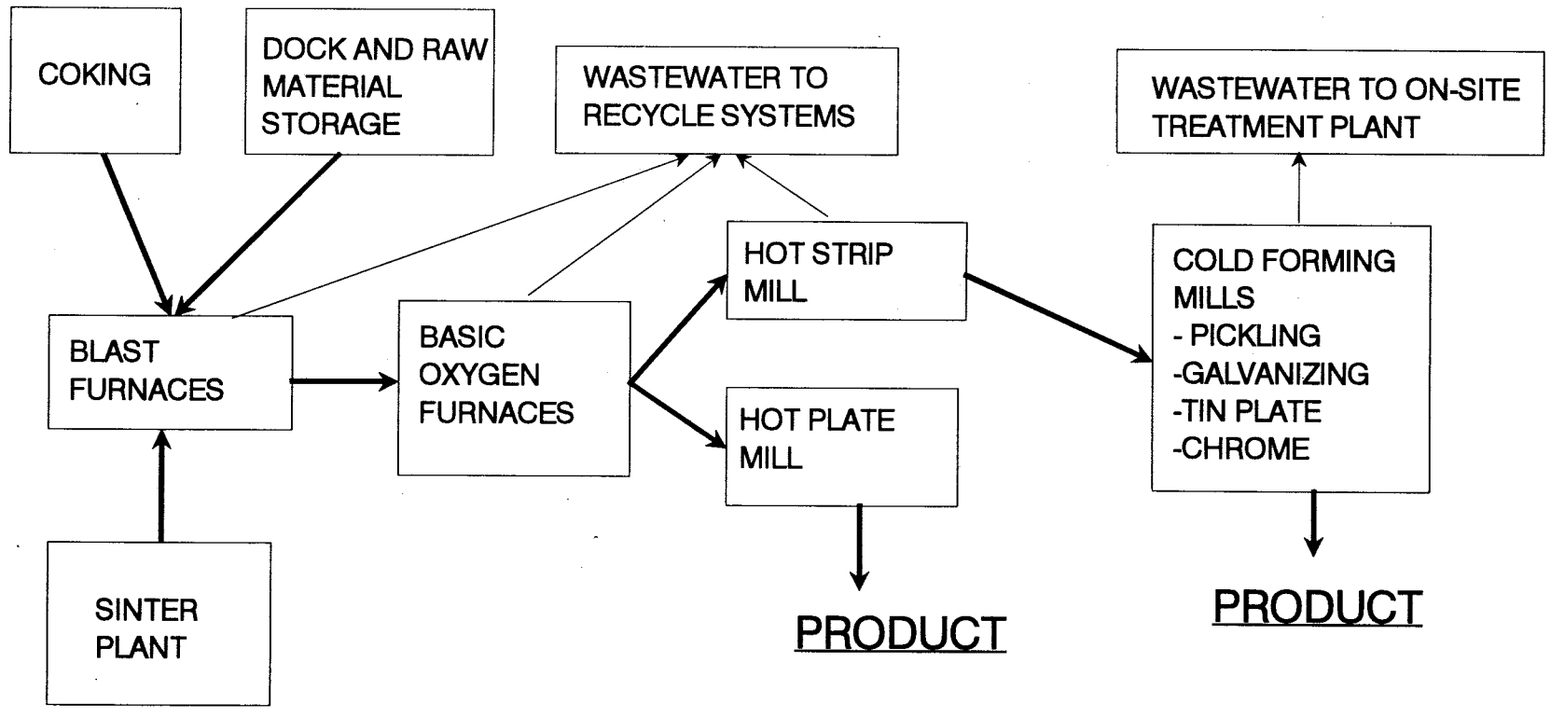
Developing an inspection strategy involves prioritizing the manufacturing processes and waste management activities with regard to inspection objectives and, in consideration of these priorities, systematically moving from the beginning to the end of an operation. Material flows should be followed, to the extent possible, beginning with raw material receiving/storage facilities, then to manufacturing areas. Utilities, maintenance, laboratory, and other activities should also be addressed, as appropriate, and prioritized. The strategy should be somewhat flexible so that "mid-course corrections" can be made. Finally, the inspection strategy must include opportunities for team member interactions to share observations and findings; daily meetings are suggested.

To illustrate an inspection strategy, based on the above factors, consider the plant processes shown in Figure D-1. The facility was inspected by a team consisting of an air inspector with a strong industrial process background, a wastewater (CWA program) inspector with extensive treatment plant evaluation experience, a RCRA inspector, and a project coordinator with a strong RCRA, CWA, and industrial process background. The objectives included doing (1) a thorough process-based inspection, (2) an evaluation of wastewater treatment plant problems and sources, and (3) an evaluation of hazardous waste management activities at the site.

The strategy developed involved the team initially splitting into three subgroups (after the opening conference and site tour, as discussed below) and later recombining into two subgroups. Initially, the coordinator and air inspector went through the more complex air and solid waste producing processes (coking, sintering, and blast furnaces). The wastewater inspector

evaluated the on-site wastewater treatment plant, and the RCRA inspector went to the regulated hazardous waste management units, which were being closed.

As the process evaluation proceeded "downstream," the inspectors recombined into two teams. The wastewater inspector joined the coordinator to inspect the hot and cold forming mills, which are major wastewater sources, and the wastewater recycle systems. The air inspector was joined by the RCRA inspector to look at the basic oxygen furnaces, the plate mill, contractor operations, and the shops. These operations were judged more likely to produce/manage solid and hazardous wastes and to have significant air emissions and controls.



ON-SITE CONTRACTORS
Slag processing
Used oil recycling
Landfill operation
Tar sludge processing
Waste pickle liquor processing

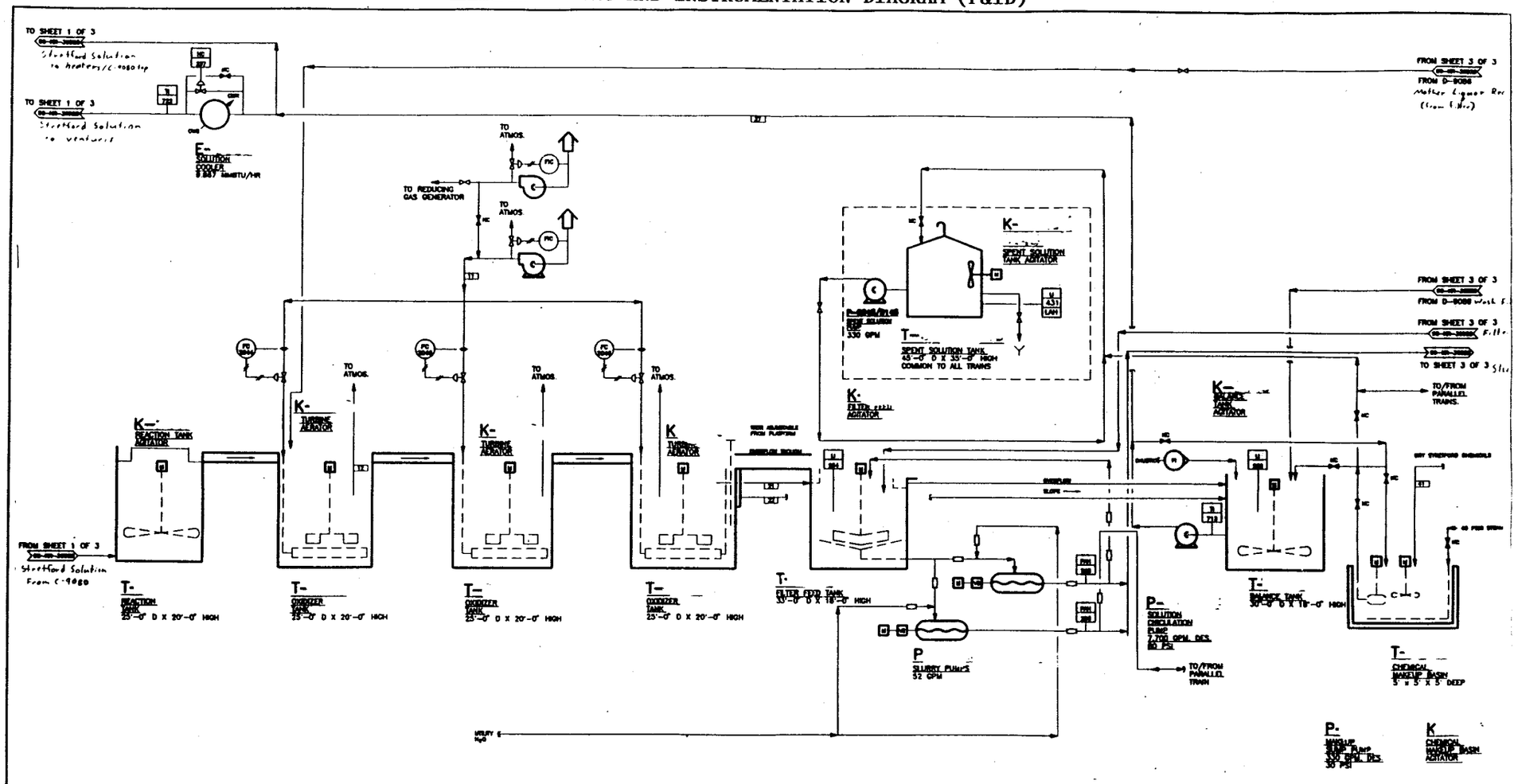
SHOPS
Railroad
Truck/auto

FIGURE D-1
GENERALIZED PLANT PROCESS FLOW DIAGRAM

APPENDIX E

EXAMPLE PIPING AND INSTRUMENTATION DIAGRAM (P&ID)

EXAMPLE PIPING AND INSTRUMENTATION DIAGRAM (P&ID)



STREAM NUMBER	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
	SCRUBBING SOLUTION CIRCULATION	CONDENSATE CIRCULATION	MAKE WATER	SOLUTION FROM ABSORBER	FROM 30 FILTER FEED TANK	SOLUTION TO BALANCE TANK	SULFUR CAKE	SLURRY TO MELTER	SLURRY TO RECOVERY	SULFUR PRODUCT	RECOVERED OVERHEAD	MOTHER LIQUOR	MAIN FILTRATE	SEAL WATER	RECOVERY CUBICH	CLASSIFIED RECOVERY OVERHEAD	STRIPPED GAS TO STACK	STRIPPED GAS TO SCRUBBER FROM COOLER	MAIN WATER	RECOVERY WATER	DIRECT SOLUTION RECIRCULATION	SOLUTION TO ABSORBER	SOLUTION TO MAIN SCRUBBER	SOLUTION TO SHUTDOWN PATCH	STRETFORD CHEMICALS
STREAM RANK																									
COMPONENTS LB/HR																									
SULFUR	–	–	–	1,275	1,275	–	1,275	1,275	1,275	1,275	–														
STRET. SOLUTION	–	–	–	3,843,882	99,139	3,817,823	548	548	548	–	248	83,878	374	–	–	246	–	–	–	–	3,843,947	261,863	1,617,886	100,000	548
WATER	415,000	415,000	21,875			–	1,814	3,794	3,794	–	3,794	2,303	3,843	50,000	25,188	30,000	6,385	6,385	4,300	1,950	3,303	200	971	193	
TOTAL	415,000	415,000	21,875	463	27,000	3,817,823	3,635	5,615	5,615	1,275	4,040	86,182	4,117	53,000	25,188	30,220	6,385	6,385	4,300	1,950	3,843,250	261,863	1,618,510	100,000	548
				3,843,000																					
SP. GR.	1.01	1.00	1.00	1.04	1.07	1.04	–	1.14	1.08	1.80	0.83	1.03	1.03	1.00	0.99	0.99	0.99	1.80	1.80	1.80	1.04	1.04	1.04	1.04	–
GPM	330	330	42	0.816	52	6,788	–	0.5	10.1	1.53	8.7	54.7	8.2	30.00	50.0	50.0	13.7	13.6	8.6	4.0	6.889	1,881	2,739	301	–
SP. GR. 1	1.01	1.00	1.00	1.30	1.30	1.33	–	1.00	1.00	1.00	0.83	1.25	1.00	1.00	0.99	0.99	0.99	1.00	1.00	1.00	1.30	1.30	1.30	1.30	–
TEMP. °F	170	90	100	194	104	104	88	88	300	300	200	103	85	70	85	115	100	95	95	95	95			104	90
PRESS PSIG	30	40	40	0	0	0	0	65	60	0	10										60	60	60	0	0

REFERENCE DRAWINGS

REVISIONS

1	UPDATED PER P&ID WALK-UP. 4/7/93	CHL 10/12	

PROCESS FLOW DIAGRAM

SCALE NONE DATE 9/27/93 APPROVED

DR. LVV CH. DR. APP. ENGR. BTD

CPS/G DEPT. ENG. DEPT.

A E.M. A/P#

SHEET 2 OF

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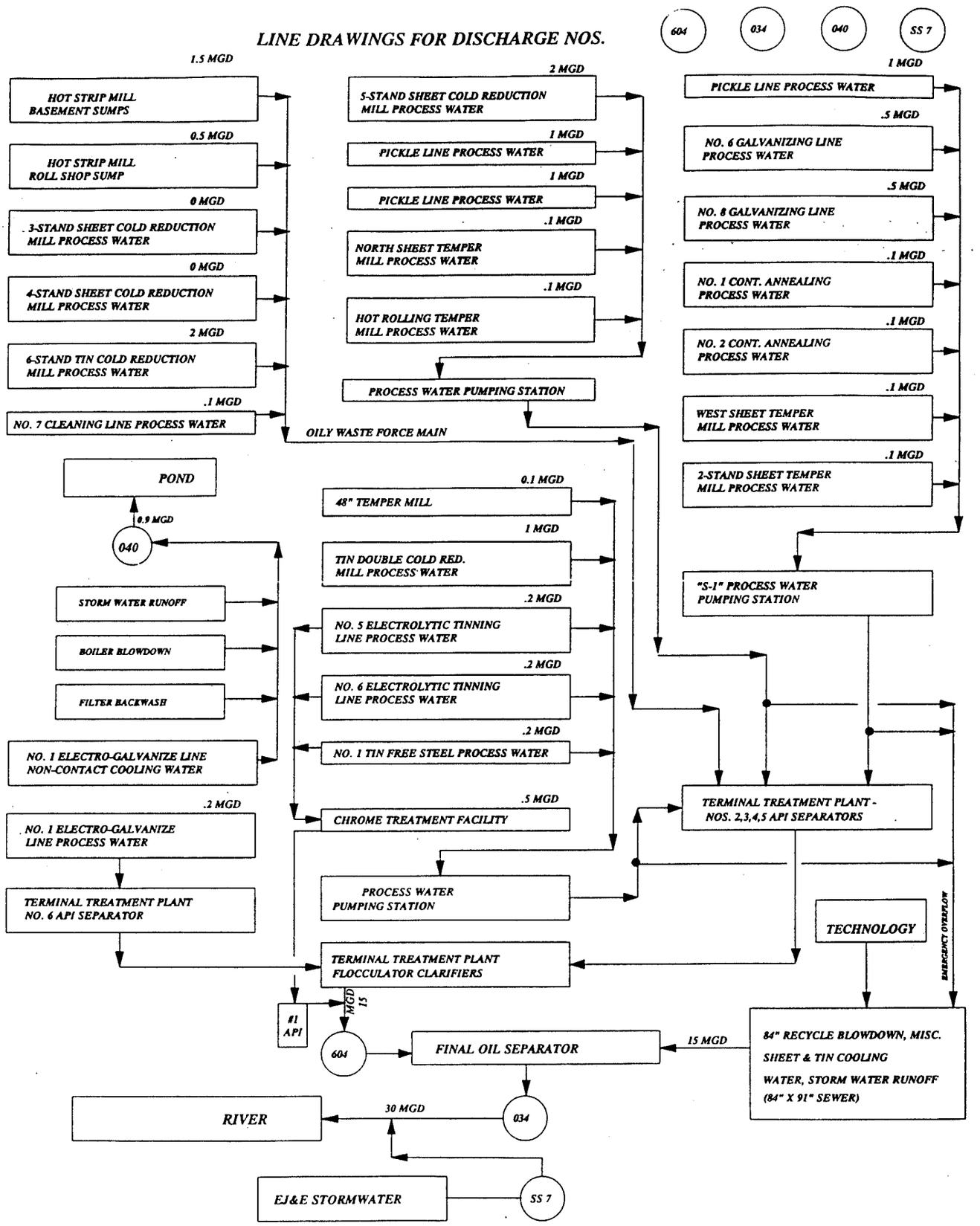
THIS IS A CAD DWG. NOT TO BE UPDATED MANUALLY

APPENDIX F

EXAMPLE FACILITY WATER/WASTEWATER BALANCE DIAGRAM

APPENDIX F

EXAMPLE FACILITY WATER/WASTEWATER BALANCE DIAGRAM



EXAMPLE OF PROCESS FLOW DIAGRAMS SHOWING ADEQUATE LEVEL OF DETAIL